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Final Project Proposal

1. Idea and Overview

We propose to implement our own modified Pac-Man game on the FPGA board using System-on-Chip (Soc), which provides a multiplayer version and some original elements. In addition to the traditional hardware elements, including RAM, VGA Controller, FPGA Hex Controller, Keyboard Receiver, and so on. All the sprites in the game assets are also hardware components in SystemVerilog in order to speed up the game runtime and improve players' experience. All the hardware components are controlled by a central Game Manager Module so that it might be easier to make changes to the states of the objects, which is also in charge of the communication between hardware and software.

2. Block Diagram
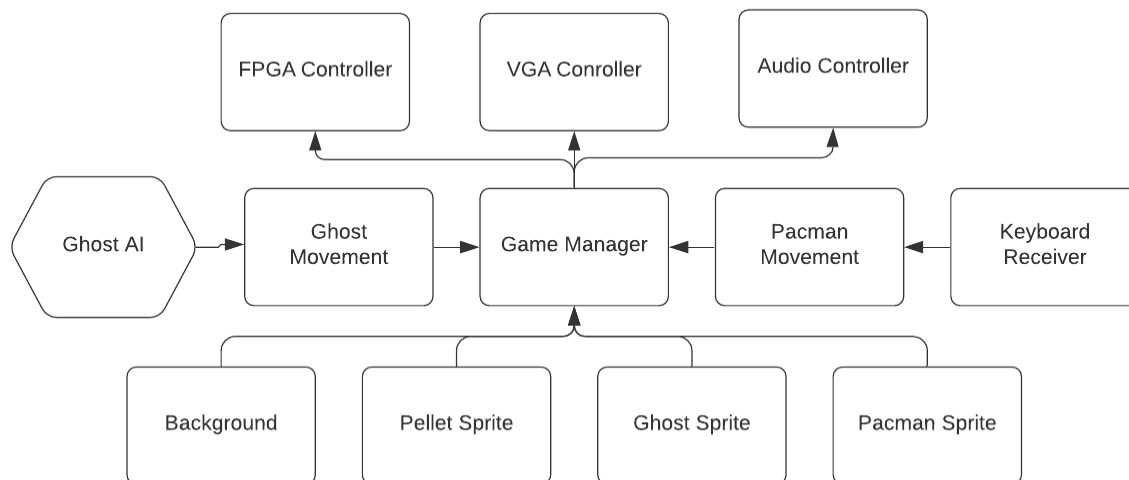
3. List of Features

Baseline Features:

Our baseline project features should include a VGA screen and keyboard input.

The game also incorporates AI enemies.

We will also be displaying the score in the game as well as on the FPGA HEX displays.

Additional Features:

The Additional features include starting screen and game over screen, etc (better GUI).

We can also implement music and other sound effects in the game.

We can add in a mouse input for gameplay with the mouse.

We can also implement multiplayer gameplay with 2 pac-mans (one controlled by WASD, and the other one controlled by arrow keys).

We can also modify the AI difficulty with smarter chase paths.

4. Expected Difficulty

The baseline project difficulty should be about a 5. We need to implement an algorithm in C to compute the movements of the ghosts, as well as accepting the pac-man's movement from our keyboard. We need to translate these movements into what the next frame would look like on a VGA monitor. We also need to create sprites for the background map, the pellets, the pac-man, and the ghosts. Lastly, we need to keep track of the score by counting how many pellets and ghosts eaten by the pac-man.

With the additional features, we can add in a multiplayer option so 2 players can control a pacman each in game. We also can add in a start game menu that allows us to choose between single player mode, multiplayer mode, or quit game. There should also be a game over menu after all lives are expended. We can also add in mouse control to select the game options with a mouse. In addition, we can add in music for the start menu, the game, as well as game over screen. We can also add in sound effects for when pac-man eats pellets, ghosts, and gets eaten by ghosts. Lastly, we can improve the smartness of the ghost AI by adjusting its chase speed, accuracy of chase path, etc.

5. Proposed Timeline

April 9 - April 16: Able to display background map/pellets and the pac-man on the monitor, and maneuver the pac-man in the map (surrounded by walls).

April 16 - April 23: Able to display the ghosts, and make them move smartly controlled by a software AI. Able to score, win, and lose correctly according to the rules.

April 23 - April 30: Add multiplayer option with parallel inputs from keyboard, start game and game over screens, and mouse controller.

April 30 - May 7: Add audio over the game and improve ghost AI algorithm.